

Bechuanaland, and Natal receive scant notice. The coastal system, including the Uitenhage and Umtavuna Cretaceous rocks, profusely illustrated with typical fossils, occupies part iii.

The superficial deposits, somewhat summarily dismissed, form a separate chapter. Many of the interesting problems connected with them are not even hinted at. A classification by chemical composition is adopted.

The igneous and volcanic rocks, which take so large a share in South African stratigraphy, are described in connection with the systems with which they are more intimately associated.

Part iv. briefly discusses the igneous rocks of doubtful position. Too much space has here been allotted to the diamond-bearing deposits.

Part v. discusses the correlation of the South African strata. It contains much information guardedly expressed. This portion possesses the almost unique virtue of stating the arguments in favour of the correlation adopted by the authors. Few geologists will now dissent from the view that the Witwatersrand series is older than the Table Mountain Sandstone and newer than the complex of rocks termed Archæan.

Latter-day geologists will miss a chapter on structural and dynamical geology. The authors, and many will no doubt agree with them, have eschewed the problems entailing the use of modern physiographical and dynamical terminology. In dealing with rocks and fossils they have, however, occasionally been compelled to drop into technical language. Thus we met with *Cardium bullennewtoni*, *Eriphylla rupert-jonesi* among fossils; while among minerals and rocks several of those mentioned wordily lengthen out what, to the general reader, would otherwise be a welcome page.

The authors have certainly succeeded in their self-imposed task "to correlate and systematise the valuable results of both official and private work." They are right in considering that what we know of South African geology lacks coherence. The best efforts, such as that of the authors, must for a long time be regarded as tentative and by no means final.

The volume is profusely and admirably illustrated with photographs of scenery and rock sections. Two coloured geological maps accompany the text, one of South Africa between Bechuanaland and the east coast and the Transvaal and the south coast, and one of the Transvaal. It is to be hoped that the half-mourning adopted for the Karroo system will not be perpetuated. Economically it is false; artistically it is ruinous.

W. G.

NOTES.

THE meeting of the French Association for the Advancement of Science was opened on August 3 at Cherbourg under the presidency of Prof. Giard.

WE regret to learn that Prof. L. Errera, professor of botany in the University of Brussels, and member of the Royal Academy of Belgium, died on August 1 at Uccle.

WE understand that the editorship of the "Fauna of British India," rendered vacant by the death of Dr. W. T. Blanford, has been offered by the Secretary of State for India to Lieut.-Colonel C. T. Bingham.

A REUTER telegram from Rio de Janeiro says that the Latin American Scientific Congress was opened on August 7, delegates from all the South American Republics being present.

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THE sixth International Congress of Criminal Anthropology is to take place in Turin on April 26 next under the presidency of Signor Bianchi, Minister of Public Instruction.

PROF. RONALD ROSS and Prof. Boyce, of the Liverpool School of Tropical Medicine, will sail for New Orleans on Saturday to assist in dealing with the epidemic of yellow fever in that city.

WE regret to see the announcement that Mr. Alexander Bell, father of Dr. Alexander Graham Bell, and an active worker in educational science, especially in relation to the study of deaf-mutes, died at Washington on August 6.

MR. CHRISTOPHER HEATH, Emeritus professor of clinical surgery in University College, London, and a former president of the Royal College of Surgeons of England, died suddenly on Tuesday, August 8. Mr. Heath was the author of several standard works on surgical subjects.

THE Amherst College expedition for the observation of the eclipse of the sun on August 30 has departed for Tripoli, where the instruments will be mounted on the edge of the desert. The members of the expedition are Prof. David Todd, Mrs. and Miss Todd, and Mr. E. A. Thompson, and their attention will be chiefly devoted to the photography of the corona and of intra-Mercurial planet regions.

THE Treasury has renewed for a further period of five years the annual grant of 500l. to the British School at Athens. The promoters of the movement hope that an influentially signed petition for a similar grant to the British School at Rome may be also favourably considered.

PROF. GUIDO CORA informs us that the earthquake disturbances registered at the Pola Hydrographic Station on July 23 (see p. 298) were also recorded at the Osservatorio Ximeniano of Florence at 3.50 a.m. on the same date. Father Guido Alfani, from an examination of the seismograms, expressed the opinion that a severe and protracted earthquake must have taken place at an estimated distance of about 6800 kilometres (4225 miles).

WE notice with regret the death on July 26 of Prof. Bichat, dean of the faculty of sciences at the University of Nancy. Prof. Bichat was also director of the Electro-technical Institute of Nancy, and took a very active part in all efforts for the improvement of secondary and higher education.

THE research fellowship in chemistry offered by the Worshipful Company of Salters, and tenable in the research laboratory of the Pharmaceutical Society, has this year been awarded to Miss Nora Renouf, who has been engaged in research work for the past two years in the society's laboratories. The Salters' fellowship is of the annual value of 100l., and was founded with the view of encouraging the application of the newest methods of scientific chemistry to the elucidation of pharmacological problems.

THE International Congress of Anatomy was opened in the morning of August 7 at Geneva. Three hundred representatives of the principal universities of Europe and America were present, including office-bearers of the five great anatomical associations of Great Britain, France, Germany, Italy, and the United States. One hundred and fifteen papers on various scientific subjects were put down for reading. The congress will conclude to-day with a banquet given by the city of Geneva to the delegates. The congress has accepted an invitation to assemble at Boston in 1907.

THE *Journal of the Royal Microscopical Society* for June contains two papers by Mr. J. E. Stead, F.R.S., one dealing with micro-metallography in general, and the other with the special processes for detecting phosphorised portions in iron and steel.

THE two articles in the July issue of the *Irish Naturalist* are devoted to local subjects, the Rev. Canon Norman completing his list of Irish ostracod crustaceans, while Mr. R. L. Praeger discusses the distribution of fumitories in Ireland.

WE have to acknowledge the receipt of a complete copy, with the plates, of the first part of vol. lvii. of the *Proceedings of the Philadelphia Academy*. Many of the papers contained in this part have been already noticed in our columns, as they appeared in the monthly issues.

WE have received a fasciculus of "Illustrations of the Zoology of the *Investigator*," containing plates of crustaceans (part xi.) and fishes (part viii.). Special interest attaches to the plate of the crab *Lithodes agassizi* on account of the large size and peculiar form of this species, and also to the plates of deep-sea fishes, a few of which have only recently been described.

MR. J. E. ROBSON continues his catalogue of the Lepidoptera of Northumberland and Durham in vol. xv., part i., of the *Natural Transactions* of the aforesaid counties, dealing in this instance with the groups Pyralidina and Tortricina. Both these sections of the Microlepidoptera are but little studied by collectors, and the author confesses to considerable difficulty in dealing with the second of the two.

IN No. 1410 of the *Proceedings of the U.S. National Museum* Mr. E. Linton describes certain cysts of a cestode worm from a bottle-nosed porpoise, which are regarded as indicating a new species of *Tænia*. No. 1404 of the same publication contains the first part of a description, by Mr. C. B. Wilson, of the North American parasitic copepod crustaceans of the family Caligidæ. An account of the Argulidæ has already appeared in the same journal; the members of the present group are regarded by the author as of the greatest possible ecological interest, so that the study of their life-history cannot fail to yield important results.

ARTICLE 7 of vol. xx. of the *Journal of the College of Science of Tokyo University* contains an account by Dr. I. Iijima of the larva of an apparently new cestode worm which was recently found infesting a Japanese woman in extraordinarily large numbers. This larva has been provisionally described as a new generic and specific type under the name of *Pterocercoides prolifer*. It is believed to be a member of the Bothriocelphalus group characterised by the absence of "bothria," a feature probably common to Ligula, with which the Japanese cestode may prove to be nearly related.

IN a paper published in the fourth volume of series iii. of the *Annales of the National Museum of Buenos Aires*, Dr. F. Ameghino records the presence of a perforation in the astragalus of the badger, the other living mammals in which this feature is known to occur being the dasyure, the giant armadillo, and the mole. The same volume contains a paper by Mr. F. Lahille on a new type of scombrid fish from Argentine waters, which has been named (in a preliminary notice published a couple of years

ago) *Chenogaster holmbergi*. This fish, of which an excellent coloured plate accompanies the memoir, is a member of the same group as the New Zealand *Lepidothynnus* and *Gasterochisma*, which inhabit the same latitude as Chubat. From the New Zealand forms *Chenogaster* differs by the united dorsal fins, while it is distinguished from *Gasterochisma* by the small ventral fins and from *Lepidothynnus* by the presence of vomerine teeth. The three genera indicate a circumpolar Antarctic group.

ON a previous occasion a special notice was given in this *Journal* of Dr. Waite's account of the nesting habits of the fighting fish (*Betta pugnax*), as observed in an aquarium. In the *Records of the Australian Museum* (vol. vi., part i.) Dr. Waite publishes a preliminary note of these habits in the allied paradise, or rainbow, fish (*Polyacanthus opercularis*), of which specimens have likewise been successfully kept in captivity. After mentioning that at the commencement of the breeding season the male assumes a gorgeous nuptial coloration, the author goes on to say that the nest of this species is simpler and flatter than that of the fighting fish, a difference probably due to the habit of the former of nesting beneath shelter. The first eggs are often laid in a small mass of bubbles, others being added later; in consequence of this the eggs are raised quite out of the water, and thus hatched. It may be added that, according to older views of nomenclature, the name *Polyacanthus* renders void that of *Polacanthus*, applied many years later to a British dinosaur.

THE migrations and growth of plaice form the subject of a communication by Mr. A. Meek to vol. i., part ii., of the new series of the *Transactions of the Natural History Society of Northumberland and Durham*. After referring to previous experiments and observations, the author states that during last year 483 plaice (inclusive of a few other flat-fishes) were caught, marked, and returned to the sea on the Northumberland coast. Of these fish 52 were recovered; and among this number only 2 made conspicuous migrations, and only 7 may be said to have left the bays where they were liberated. Apparently, the small plaice on the Northumberland coast gradually travel from the sandy pools to the adjacent deeper water, where they spend the remainder of their immature condition. When four or five years old they migrate into the still deeper extra-territorial waters, and apparently show a constant tendency to reach increasing depths with advancing age.

A RESTORATION of one of the huge Miocene American perissodactyles of the family Titanotheriidae is attempted by Prof. R. S. Lull in the July number of the *American Naturalist*, the species in question being a member of the genus or group *Megacerops*. The creature stands about 7 feet 4 inches at the withers, and measures rather more than 12 feet in length. The general proportions are those of a rhinoceros, although the limbs, probably to support the enormous weight of the body, are less angulated, and primitive features are displayed by the shortness of the back and in the structure of the fore-foot. Indeed, if we are to accept Prof. Lull's description of the latter, the definition of the group Perissodactyla requires modification, for the fore-foot of this titanother is stated to be four-toed and symmetrical, with the main axis lying between the third and fourth digits after the artiodactyle fashion. As regards the nasal horns, which are branched at the summit, the author is inclined to believe, from the absence of groovings on the bone, that

the basal portion (which is all now remaining) was clothed with skin during life, and that upon this were growths comparable to the horns of modern rhinoceroses.

PROF. ALBERT M. REESE, of the Syracuse University, has gone to Florida, under the auspices of the Smithsonian Institution, says the *Scientific American*, to collect eggs of the alligator with which to work out its embryology; subsequently he will spend some time at the biological laboratory of the Carnegie Institution of the Dry Tortugas studying the material he collects. Twenty-five years ago alligators existed in great abundance in the region ranging from North Carolina to the Rio Grande of Texas, but as alligator leather became fashionable about that time the demand thus created has reduced the supply by at least 98 per cent. It is said that a person may travel now from Jacksonville to Miami, Fla., without seeing a single alligator. It is estimated that 2,500,000 alligators were killed in Florida from 1880 to 1894.

THE list of new garden plants for the year 1904 has been published as appendix iii. to the *Kew Bulletin*. This list not only affords information respecting new plants, but also gives official authentication to the names, thereby providing an accurate guide for horticulturists.

A REVISION of the genus *Zexmenia*, prepared by Mr. W. W. Jones, has been issued as No. 7 of vol. xli. of the *Proceedings of the American Academy of Arts and Sciences*. The genus is one of the helianthoid Compositæ restricted to tropical and subtropical America.

NATURE-STUDY, so far as it is founded on the four faculties of observation, deduction, memory, and constructive imagination, is closely allied to the methods of Sherlock Holmes; such is the gist of an article by Mr. Lamborn in the May number of the *Nature-study Review*, and teachers in search of a novelty in nature-study may be referred to the example which is quoted. A short article on observation bee-hives for the schoolroom, by Miss Comstock, suggests another line of work. There is also much truth in the reasons which Mr. L. A. Hatch assigns for failure in teaching the subject, the first and foremost being a want of the observational instinct.

THE *Indian Forester* for June contains many interesting articles relating to forestry and kindred subjects. A new species of *Diospyros* (*D. Kanjilali*) is described and figured by J. F. Duthie. An article on the prohibition of grass burning and its effects on the game of the country will be read with interest by both forester and sportsman. Another valuable illustrated article, entitled "Some Facts about Gutta Percha," by Mr. A. M. Burn Murdoch, contains a great amount of useful information, especially regarding the rubber trees of the Federated Malay States. The article gives a very clear idea concerning the species and their distribution, the measures adopted for their protection, together with harvesting, manufacture, and properties of the gutta percha. There are many other papers and reviews, together with matters of general interest, which will repay perusal by those interested in forestry and its sister subjects.

THE broad-minded view which the U.S. Department of Agriculture takes of its function for instituting inquiries is well exemplified in three bulletins which have been received from the Bureau of Plant Industry. In Bulletin No. 68 Mr. A. S. Hitchcock presents a carefully prepared classification of North American species of *Agrostis*. The author, in the preparation of this memoir, has consulted all the large herbaria in Europe; the number of species,

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including three new to science, is limited to twenty-seven, and these, together with the principal varieties, are fully described and illustrated. A method of exterminating Johnson grass by means of a root-digger is explained by Mr. W. J. Spillman in Bulletin No. 72, and the problem of range management in the State of Washington is discussed by Mr. J. S. Cotton in Bulletin No. 75. The latter pamphlet deals with the protection and seeding of land which had been over-grazed by nomadic stockmen. Experiments on land situated at an altitude of 5000 feet demonstrated that Timothy, brome-grasses, and tall fescue would be found suitable for sowing on these mountain pastures.

WE have received a copy of the year-book of the Norwegian Meteorological Institute for 1904, containing hourly observations of air pressure and temperature for Christiania, in addition to observations made three times daily, and monthly and yearly summaries at a number of other stations in Norway. There is also a valuable appendix showing the departures of the monthly and yearly values from the normal at a number of stations for each year from 1874 to 1904. Since 1903 the station at Bergen has undertaken the duties of weather prediction and storm warnings for the western part of Norway. This arrangement allows Prof. Mohn, director of the Norwegian Meteorological Institute, to devote more attention to general climatology, and is conducive to more rapid dissemination of forecasts of the depressions arriving from the Atlantic.

THE *Annuaire météorologique* of the Royal Observatory of Belgium for 1905, published under the superintendence of M. A. Lancaster, director of the Belgian Meteorological Service, contains a large amount of useful information relating to that country in particular and to meteorological science generally. For sixty-eight years the *Annuaire* referred to astronomy and meteorology combined, but since 1901 each of these sciences is separately dealt with. Some 240 pages of the work now in question contain valuable data relating to the variability of atmospheric pressure and rainfall for each month since 1833, and to the frequency of sunshine since 1886. The following contributions are worthy of special notice:—(1) A discussion of the late spring and early autumn frosts by Dr. Vanderlinden, containing valuable particulars as to the conditions under which they generally occur, and the possibility of foretelling their occurrence. (2) A bibliography of meteorological treatises by M. L. Vincent from the earliest times. The author gives most attention to general treatises, but anyone wishing to study special subjects, e.g. marine, agricultural, and medical meteorology, or weather prediction, will find it an invaluable guide. (3) A collection of meteorological and physical constants and conversion tables which will be found exceedingly useful for general reference.

CAPTAIN H. G. LYONS contributes to the *Geographical Journal* for August an instructive summary of the dimensions of the Nile and its basin. The length of the Nile is given usually as 5400 kilometres (3355 stat. miles) to the centre of Lake Victoria, or 6000 kilometres (3728 stat. miles) for the continuous water-way from the source of the Kagera to the sea; the area of its basin is given as about 2,900,000 square kilometres (1,119,737 square miles). It is now possible to measure the length of the river with sufficient accuracy to furnish a value which later surveys probably will not materially alter. The length of the Nile from Ripon Falls to Rosetta mouth is 5589 kilometres, or 3473 miles. The area of the catch

ment basin has been calculated from a map on the scale 1:4,000,000 for the Sudan and Uganda, and from one of 1:2,000,000 for Egypt. The area of catchment of the Nile basin is 2,867,600 square kilometres (1,107,227 square miles). The area of the basin will vary according to the distance to which its limits are considered to extend on the west of the Nile northwards of Khartum. Captain Lyons has taken it as far as the cliff of the desert plateau, or the first marked rise of the desert where the cliff is absent, probably, on the average, about 3 to 4 kilometres (2 to 2½ miles) from the edge of the cultivation. The whole of the Nile basin below Khartum, and practically all the White Nile basin, are non-effective in increasing the river supply, since the occasional local cloud-bursts may be neglected. The Bahr el Ghazal, as has been shown by recent measurements of the volume discharged, is also practically non-effective.

MR. S. TETSU TAMURA has contributed to the *Monthly Weather Review* (February and April) two papers dealing with applications of the Fourier methods of analysis, one to ice formation and the other to the nocturnal cooling of the atmosphere.

A VERY compact form of direct-reading cymometer for the measurement of wave-lengths and frequencies in connection with electric-wave telegraphy is described by Prof. J. A. Fleming in vol. xix. of the *Proceedings of the Physical Society of London*. In the described form the cymometer can be used to measure not only the length of the outgoing wave from a sending aerial, but also the length of the wave being received. The instrument can further be used for measuring the capacity of a Leyden jar or the inductance of a circuit for high-frequency currents.

IN the *Journal de Physique* for May, M. Adrien Guébhard contributes a paper on photographic action, illustrated by curves showing the darkening due to development as a function of the time, and the superficial changes as a function of the sum of the causes producing them—as he calls it, the "photographic function." It is well known that the effect of greatly over-exposing a negative is to reverse the photographic action, sometimes producing a positive instead of negative impression. M. Guébhard discusses the theory that the photographic function, after reaching its maximum and descending to a minimum, attains a second maximum, followed by a second minimum, and he describes experiments in support of this view.

PROF. O. ZANOTTI BIANCO, of Turin, has published (Florence: L. S. Olschki, 1905) a short discussion on Dante's "Quaestio de Aqua et Terra" considered in the light of modern geodesy. The question as proposed by Dante was essentially whether the water of the terrestrial globe is anywhere higher than the land which emerges from it. This question resolves itself largely into what is the definition of height adopted. According to Dante's belief that the earth was a sphere, points would be at the same height if they were equally distant from the centre, and the fact that the earth is not spherical, but ellipsoidal, would thus afford, in effect, an answer to Dante's question according to which the sea-level is considerably higher at the equator than at the poles. This particular interpretation appears to be the one favoured by Prof. Bianco.

No. 29 of the monograph supplements of the *Psychological Review* contains the first part of a new series of "Yale Psychological Studies," edited by Prof. Charles

H. Judd, a large part of which is devoted to a series of studies of eye movements in connection with optical illusions. The contributors are Messrs. C. H. Judd, Cloyd N. Macalister, W. M. Steele, E. H. Cameron, and Henry C. Courten. Some idea of the researches on eye movements may be obtained from the following necessarily fragmentary summary. In order to trace the movements of the eye during the fixation of different points in the visual field, a tiny speck of Chinese white was attached to the cornea, and kinematographs were taken showing its movements as the subject followed the various details of a diagram. This was applied in the case of several well known optical illusions in which the lines of figures appear distorted or equal lengths appear unequal. In another series of experiments the subject was made to record his impressions by a series of pin pricks.

IN the *Bulletin de l'Académie Royale de Belgique*, No. 5, p. 201, Prof. W. Spring describes experiments which he has made on the limit of visibility of fluorescence. A conical beam of light of great intensity was brought to a focus in solutions of fluorescein of gradually increasing dilution. Fluorescence was perceptible on an area equal to one square millimetre at the apex of the conical beam, when the solution contained 1×10^{-15} gram of fluorescein, but imperceptible when the solution was ten times more dilute. On the assumption that in the limiting fluorescent condition at least one molecule of fluorescein is present in each cubic centimetre of solution, the value 1×10^{-18} gram is calculated as the superior limit of the weight of a molecule of fluorescein, and 2.5×10^{-21} gram as that of the weight of an atom of hydrogen.

SOME interesting observations on the decomposition of silver oxide at high temperatures are recorded by Mr. G. N. Lewis in the current number of the *Zeitschrift für physikalische Chemie* (vol. lli. p. 310). The velocity of decomposition of the oxide, when heated at 330° C. to 350° C., is at first so small that no appreciable evolution of oxygen is observed during several hours. The rate of change increases rapidly, however, as decomposition proceeds, passes through a maximum, and then gradually falls to zero. Experiments carried out to elucidate the peculiar phenomenon indicate that the reaction is autocatalytic, the silver produced by the decomposition being the catalytic agent. Other substances, such as platinum black and manganese dioxide, are found to exert a similar influence on the rate of decomposition of silver oxide.

A CONTINUOUS series of articles on the radio-activity of the soil and of the atmosphere is being written for *Le Radium* by Prof. Geitel. These articles connect together the several original papers published by Prof. Geitel in conjunction with J. Elster, many of which have already received notice in these columns. The number of *Le Radium* for July 15 contains in addition an article on the results obtained by the use of radium in the treatment of cutaneous cancer. It is illustrated by some striking photographs.

IN a brief note in the current number of the *Atti dei Lincei* Prof. A. Righi states that, using an experimental method essentially different from that employed by Prof. McClelland, he has obtained results which fully confirm the connection maintained by the latter to exist between the atomic weight of a substance and the amount of secondary radiation which it emits when subjected to the β and γ rays of radium (compare *NATURE*, vol. lxxi., p. 543, and lxxii., p. 158). The method used was to measure the change of potential of a disc of the material suspended

in a vacuum when subjected to the radiation of radium. The disc being under two influences, namely, an increase in the negative charge owing to the impact of the β electrons and a loss of negative charge owing to the emission of a secondary radiation, the actual rate of accumulation of the negative potential measured inversely to the rate of production of the secondary radiation.

THE Engineering Standards Committee has issued a report on the effect of temperature on insulating materials. A series of measurements showing the influence of temperatures ranging from 75° C. to 150° C. on the disruptive voltage, the resistance and the mechanical properties of the insulating materials used in industry, were made by Mr. E. H. Rayner at the National Physical Laboratory, by Messrs. Crompton and Co. at Chelmsford, and by Messrs. Siemens Bros. and Co. at Woolwich. The electrical properties of the materials do not seem to be greatly influenced by exposure at the temperatures given, but the material itself perishes on long-continued heating. An interesting point established is the extraordinary increase in resistance of the insulating substances which, owing to the removal of water, accompanies drying at 100° C. The price of the report is 5s. net.

AN interesting Parliamentary return just issued gives some particulars of the first three months' working of the Wireless Telegraph Act. Part of the return relates to licences, seventy-eight applications for which have been received; the majority of these are for experimental purposes, but a fair number are for commercial purposes. No less than four companies have applied for licences to establish stations to communicate with America; two of these have been granted, one is under consideration, and the fourth is offered with an alteration in locality. The paper also contains particulars of the working of the arrangement between the Post Office and the Marconi Co. It seems that 111 messages have been received by the Post Office for transmission to outward bound ships, of which 21 could not be delivered (in six cases at least through the senders' fault in transmitting after the latest guaranteed time). The number of messages received from ships at sea is 1655, which, if it does not represent a very great volume of business, still serves to show that the system is beginning to develop in practical utility.

A MOST interesting paper on a new carbon filament, read recently by Mr. Howell before the American Institute of Electrical Engineers, is published in the *Electrician* for July 28. The author claims to have produced a new allotropic modification of carbon, so different are the physical and mechanical properties of his filament, which is prepared in the following way:—An ordinary carbon filament made from a solution of cellulose is baked to as high a temperature as possible in an electric resistance furnace; it is then "flashed" in the usual manner, and afterwards again electrically baked. Although the first electrical baking considerably affects the final result, it seems that the graphite coating deposited during flashing undergoes a very marked change during the subsequent baking, which is especially remarkable considering the high temperature at which the deposit is formed. The filament possesses a very much lower specific resistance than ordinary filaments, and this is a disadvantage from the point of view of practical lamp making; but, on the other hand, the resistance-temperature curve rises instead of falls, which is a distinct gain, and will undoubtedly confer on the lamp an indifference to fluctuations of line voltage, and so enable it to be run at a high efficiency.

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The inventor claims a useful life of 500 hours at a power consumption of 2.5 watts per candle, which is an extremely good result for a carbon lamp.

THE De La More Press will publish in the autumn "A First German Course for Science Students," by Prof. H. G. Fiedler and Dr. F. E. Sandbach.

WE have received a copy of the first volume of the "Collected Researches" of the National Physical Laboratory. The volume contains five contributions, viz.:—An analysis of the results of the Kew magnetographs on "quiet" days during the eleven years 1890-1900, by Dr. Charles Chree, F.R.S.; the high-temperature standards of the National Physical Laboratory, by Dr. J. A. Harker; the construction of some mercury standards of resistance, with a determination of the temperature coefficient of resistance of mercury, by Mr. F. E. Smith; the range of solidification and the critical ranges of iron-carbon alloys, by Dr. H. C. H. Carpenter and Mr. B. F. E. Keeling; and the resistance of plane surfaces in a uniform current of air, by Dr. T. E. Stanton. All the papers have been published previously, three of them in the *Transactions of the Royal Society* and two in journals of other scientific bodies. As Lord Rayleigh says in a preface to the volume:—"A multitude of other problems of scientific and technical importance press for solution. Some of these are already in hand, but the rate at which progress can be made will depend in great measure upon the amount of support which may be forthcoming from those more immediately concerned in the development of industry. It is hoped that the publication of the present volume may serve as a stimulus, by showing the character of the work of which the Laboratory and the Staff are capable."

PROF. N. ZARUDNOI publishes in vol. xxxvi. of the Memoirs of the Russian Geographical Society the herpetological and ichthyological results of his journeys in eastern Persia. The Reptilia are represented by 72 species, the Amphibia by 6 species, and the fishes by 17 species, many of which, especially among the first division, are new species described by Prof. A. M. Nikolsky.

THE last volume of the Memoirs of the Russian Geographical Society, for ethnography (vol. xxv., 1), contains a very valuable bibliography, by M. Baltramaitis, of everything that has been printed about Lithuania (8514 titles), its geography, history, law, statistics, and ethnography, including folklore. This volume, which covers 614 pages, is followed by an appendix, which contains a list of Lithuanian and old Prussian books printed from the year 1553 to 1903 (2665 titles). The whole is admirably indexed.

NOTICE is given by the Clarendon Press of the first part of a new book on "Elementary Chemistry," by Mr. F. R. L. Wilson and Mr. G. W. Hedley. According to the preliminary announcement which has reached us, the ultimate object of the authors is "the cultivation of a scientific habit of mind in the pupils, through the medium of chemistry, rather than the mere acquisition of the facts of science."

MR. JOHN HEYWOOD has published a fourth edition of Mr. R. L. Taylor's "Student's Chemistry." The book has been enlarged and revised by Mr. J. H. Wolfenden, and an appendix on the radio-active elements and an introduction to the study of organic chemistry has been added. The volume contains more than six hundred

questions and problems, and is likely to continue to be a popular manual on the outlines of inorganic chemistry and chemical philosophy.

MESSRS. MACMILLAN AND CO., LTD., have issued a new and revised edition of stage vi. of Mr. Vincent T. Murché's "Object Lessons in Elementary Science," the price of which is 2s.

A FIFTH edition of Mr. W. W. Fisher's "Class Book of Elementary Chemistry" has been issued by the Clarendon Press, Oxford. The text has been entirely revised, and numerous additions have been made. Several chapters on organic chemistry, intended to serve as an introduction to this division of the subject, have been included in the new edition, which is now in line with the present state of knowledge of the subjects dealt with in the volume.

OUR ASTRONOMICAL COLUMN.

JUPITER'S SIXTH AND SEVENTH SATELLITES.—A telegram from Prof. Pickering to the Kiel Centralstelle announces that Dr. Albrecht has observed the recently discovered sixth satellite of Jupiter with the Crossley reflector of the Lick Observatory. The times of observation and the determined positions were as follows:—

G.M.T.	Position angle	Distance
1905 July 25 ⁹⁵	55° 0'	25° 1'
," 26 ⁹⁷	52° 7'	24° 3'
," 27 ⁹³	50° 7'	23° 6'

(Circular No. 77, Kiel Centralstelle).

In Bulletin No. 82 of the Lick Observatory Dr. Frank E. Ross publishes the following set of elements for the orbit of Jupiter's seventh satellite, which he has computed from the observations made by Prof. Perrine on January 3, February 8, and March 6:—

Ecliptic Elements.

Mean Jovicentric Longitude at Epoch	333° 55'	1905
Longitude of Perijove	336° 65'	
Node	237° 23'	
Inclination to Ecliptic	31° 0'	
Jupiter's Orbit	32° 0'	
Longitude of Node on Jupiter's Orbit	238° 6'	Jan. 0°

Elements referred to Earth's Equator.

Mean Jovicentric Right Ascension	328° 18'	G.M.T.
Right Ascension of Perijove	331° 28'	
Node	281° 13'	
Inclination to Equator	26° 2'	
Mean Daily Motion = 1° 358'		
log $a = 8.9004$		
$a = 52^{\circ} 54$ (for log $\Delta = 0.71624$)		
$e = 0.2446$		
$P = 265^{\circ}$ days		

Distance at maximum elongation = 70°.

Calculating from these elements the positions at the times of Prof. Perrine's observations, it was found that the residuals were satisfactorily small, but for five intermediate dates, on which observations were secured, they proved to be larger than were expected. Dr. Ross accepts this result as evidence of the large periodic perturbations, chiefly solar, to which the satellite is subjected. The above elements indicate that this satellite revolves about Jupiter in a *direct* orbit, for although a retrograde orbit was computed and found to fit the three primary observations, it did not agree with the positions obtained from the intermediate observations.

An ephemeris, covering the period July 1 to November 13, from which the following positions are taken, accompanies Dr. Ross's paper:—

	φ.	s.		φ.	s.
Aug. 10	294	26	Sept. 9	292	53
," 20	293	36	," 19	291	58
," 30	293	45	," 29	290	59

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On October 4 the distance will still be 59', but after that date it will slowly decrease, until on November 13 it will be only 18'.

According to a note communicated by Prof. Perrine to the Astronomical Society of the Pacific, and reproduced in No. 4035 of the *Astronomische Nachrichten*, Dr. Ross has also computed the orbit of Jupiter's sixth satellite. This satellite, like the seventh, moves in a direct orbit, its period being 242 days. The eccentricity of the orbit is large, amounting to 0.16, and the inclination to the plane of Jupiter's equator is about 30°. The mean distance of the satellite from Jupiter is about seven million miles. Thus the periods, and therefore the distances from Jupiter, of the sixth and seventh satellites are nearly alike, their orbits mutually interlocking. Otherwise the two orbits are dissimilar.

THE FORMATION OF THE NEW NORTH POLAR CAP ON MARS.—According to Mr. Lowell's observations, as recorded in No. 22 of the *Lowell Observatory Bulletins*, the first frost of this year in the Arctic regions of Mars occurred on May 19. The region wherein the phenomena were observed had been under daily scrutiny since coming into view on May 11, but no new feature had been discovered. However, on May 19 an enormous, unmistakably white patch was seen which extended from the western edge of the old cap to a point on the terminator about one and a half times the old cap's diameter away, and reached down to latitude +63°. The deposit was so thin on its northern edge that the band girdling the old cap could be plainly seen showing through it, but on May 20 a bright nucleus formed on the southern edge of the frost-bound area.

The date of the first observation corresponds to August 20 in our calendar, and is 126 days after the summer solstice in the northern hemisphere of Mars. In 1903 the first frost effects were observed on Mars about 128 days after the summer solstice; thus the recent observation strongly confirms those made in 1903.

LIQUID AIR—PRODUCTION AND APPLICATIONS.¹

IN the former of these papers the author details experiments showing the trustworthiness of a German silver platinum couple to measure temperatures in the neighbourhood of those of liquid air and liquid and solid hydrogen. The electric resistance of metals is an unsafe guide at very low temperatures, and the manipulation of gas thermometers involves much time and care. A thermoelectric junction would be much more convenient if trustworthy. That it is trustworthy the experiments go to show, but only within limits. If the constants of the formula for interpreting the observations be determined at temperatures between 90³° and 123¹° abs., the formula will then give the temperature of solid hydrogen at low pressure as 15².27 abs., whereas if the constants be deduced from experiments at a lower temperature, 20¹° to 77¹°, the interpretation formula then makes the temperature of solid hydrogen at low pressure 1³° lower, i.e. 13⁰.5 abs., which the author considers more correct. Bearing in mind that at this very low temperature a difference of 1³° is equivalent to a difference of 37° at the ordinary temperature, we see that the method has no confirmatory value, and can itself be trusted only over the range for which it has been verified by the careful use of gas thermometers. If, therefore, helium be procured in sufficient quantity for liquefaction or solidification, its lower temperatures, possibly within 5° of the absolute zero, will have to be ascertained by the low-pressure helium thermometer. For ranges of temperature over which its indications can be verified, the thermoelectric junction thermometer will have a useful sphere of work in saving the inconvenience of employing gas thermometers. Among important cautions given by the author is a warning that junctions made with soft solder are affected by the low temperature. The junctions should be made with hard silver solder, and the indications at the temperature

¹ "On the Thermo-electric Junction as a Means of Determining the Lowest Temperatures, and in Liquid Hydrogen and Air Calorimeters." Papers by Sir James Dewar, read before the Royal Society, June 8, 1905.